CALDose_X online: Web-based, real time Monte Carlo calculations for patient dosimetry in X-ray diagnosis

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1. INTRODUCTION

CALDose_X 5.0, available at www.caldose.org for download, is a software program for the calculation of absorbed doses and radiological risks in the human body caused by exposure of patients in radiodiagnostic.

The software uses conversion coefficients (CCs) between organ absorbed doses and incident air kerma (INARK), entrance air kerma (ESAK) and air kerma area product (AKAP) for the MASH and FASH reference phantoms in standing and supine position. However, most patients have not the anatomical properties of the ICRP reference adults.

2. MATERIALS AND METHODS

2.1 Dosimetry

36 anthropometric phantoms, 18 in standing and 18 in supine position, 9 per gender and posture with combinations of 3 different body masses and 3 different heights are connected to the EGSnrc MC code.

24 different X-ray examinations with various projections can be simulated using spectra with 2.0 – 5 mm Al filtration between 60 and 150 kVp and different focus-to-detector distances (FDD).

2.2 The Internet connection

CALDose_X online was designed to work via the Internet as a web server. Communication between the server and the database, containing information about user records and examinations, are made using PHP and SQL scripting.

3. RESULTS

On the first page of the CALDose_X online website the user is asked to select gender and posture. Here: Male patient in supine position.

Next the phantom and the examination have to be selected. Here: A 50th mass and 90th height percentile male phantom and a radiograph of the small intestine.

Now, the user has to define exposure parameters like peak voltage, aluminium filter and FDD, as well as the age. At this point, CALDose_X online is ready to calculate CCs for organ and tissue absorbed doses, as well as cancer risks normalized to INARK, ESAK and AKAP for the X-ray examination selected.

4. Conclusion

CALDose_X online (www.caldose.org) provides organ and tissue absorbed dose assessment for male and female adults as a function of posture, body mass and height by real time Monte Carlo calculation via the internet. The software covers 24 X-ray examinations for standing and supine posture for adult patients with body masses between 59.3 kg and 108.5 kg for males and between 48.6 kg and 94 kg for females. Standing heights cover the range from 167.3 cm to 185.6 cm for males and from 155.5 cm to 172.2 cm for females. Typical run time for the simulation of a radiograph is 60-90 seconds, CALDose_X 5.0 and online are used every day by more than 700 registered users in more than 40 countries.

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